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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Heinz Bauer

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Ballard Spahr LLP

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EXAMINER

PETTITT, JOHN F

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/573,213	<b>Applicant(s)</b> BAUER ET AL.	
	<b>Examiner</b> John F. Pettitt	<b>Art Unit</b> 3744	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 10 September 2010.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-6 and 8-26 is/are pending in the application.
- 4a) Of the above claim(s) 8-26 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-6 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftperson's Patent Drawing Review (PTO-948)                        | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## DETAILED ACTION

### *Claim Objections*

Claims 2 and 4 are objected to because of the following informalities: the recitation, "the second cooling circuit" (line 4 in claim 2 and line 2 in claim 4) lacks antecedent basis and should read --the second **refrigeration** circuit--. Appropriate correction is required.

### *Claim Rejections - 35 USC § 112*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-6 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In regard to claim 1, the recitation, "is drawn off after providing preliminary cooling and is returned for additional for the preliminary cooling of the hydrocarbon-rich flow" (lines 8-9) is indefinite as there is no discerning what 'for additional for the preliminary cooling' should include. In addition, the applicant's specification does not teach that there is a part flow (or any flow) of the second refrigerant that provides preliminary cooling to the hydrocarbon-rich flow and is then returned to provide additional preliminary cooling. See specification page 12, lines 15-35 wherein the second refrigerant is cooled in E1 first and is then expanded by valve (c) and contributes to the pre-cooling of the hydrocarbon flow.

***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-6 are rejected under 35 U.S.C. 102(b) as being anticipated by Stockman (US 6253574). In regard to claim 1 and 6, Stockman teaches a method for the liquefaction of a hydrocarbon-rich flow (1), whereby the liquefaction of the hydrocarbon-rich flow (1) is effected against a refrigerant circuit cascade consisting of three refrigeration circuits (column 2, lines 35-40; PRC, LRC, SRC), whereby the first (PRC) of the three refrigeration circuits serves to provide preliminary cooling (interpreted as cooling of the natural gas before liquefaction of the natural gas begins), the second refrigeration circuit (LRC) serves to provide liquefaction (column 3, line 45), and the third refrigeration circuit (SRC) serves to provide subcooling (column 4, lines 20-22, 35) of the liquefied hydrocarbon-rich flow (1), and whereby each refrigeration circuit comprises at least one single-stage or multi-stage compressor (P3, L3, S3), wherein at least one part flow (part of flow toward L13) of the refrigerant of the second refrigeration circuit (LRC) is drawn off after being preliminarily cooled (in E1 and E2) and is returned to provide additional preliminary cooling (after expansion in L13, second refrigerant provides further cooling to the natural gas before the natural gas becomes liquid as the entering natural gas into E2 is not yet liquefied) of the hydrocarbon-rich flow (1). In regard to claim 2, Stockman teaches the part flow (part to L13) of the refrigerant of the second refrigeration circuit

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(LRC) used for the pre-cooling of the hydrocarbon-rich flow (1) is evaporated at a pressure (column 7, line 35) which is higher than an evaporation pressure of a remaining part flow (part toward L9) of the refrigerant of the second refrigeration circuit (LRC), and is conducted to the compressor (L3) of the second refrigeration circuit (LRC) at an intermediate pressure level (column 7, line 35). In regard to claim 3, Stockman teaches separation of unwanted components (column 5, lines 45-50) before the liquefaction of the hydrocarbon-rich flow (LRC). In regard to claim 4, Stockman teaches at least one part of the second refrigeration circuit (LRC) is used for cooling in a separation unit (T2, as cooling for separation in T2 is provided by part of the LRC; further one may also refer to the entire apparatus of Figure 4 and 2 as a separation unit, and in such a case the second refrigeration circuit LRC would also provide cooling as claimed). In regard to claim 5, Stockman teaches that the volumes and/or evaporation pressures of two part flows (toward L13 and toward L9) are changeable (as compressor can operate at different pressures and flow rates and valves can operate at varying pressure drops).

Claims 1, 3-6 are rejected under 35 U.S.C. 102(b) as being anticipated by Dubar (US 5768912). In regard to claims 1 and 6, Dubar teaches a method for the liquefaction of a hydrocarbon-rich flow (1), whereby the liquefaction of the hydrocarbon-rich flow is effected against a refrigerant circuit cascade consisting of three refrigeration circuits (see the designation of each below), whereby the first (114) of the three refrigeration circuits serves to provide preliminary cooling (within 100; column 6, line 18; column 10,

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line 33), the second refrigeration circuit (10,11,12,22,23,24,19,20,21,37) serves to provide liquefaction (via 101, 102, and/or 103; column 12, lines 1-5), and the third refrigeration circuit (10, 14, 15, 16, 17, 18) serves to provide sub-cooling (via 104; column 11, line 59) of the liquefied hydrocarbon-rich flow, and whereby each refrigeration circuit comprises at least one single-stage or multi-stage compressor (in 114, (111, 112), and 113), wherein at least one part flow (part of 21) of the refrigerant of the second refrigeration circuit (10,11,12,22,23,24,19,20,21,37) is drawn off (sent via line 37) after flowing through pre-cooling heat exchanger (100) and is returned (to heat exchanger 100 via lines 26 and 33) for additional preliminary cooling of the hydrocarbon rich flow (1). In regard to claim 3, Dubar teaches separation of unwanted components (in A; column 8, lines 60-65) before the liquefaction of the hydrocarbon-rich flow (in heat exchangers 101, 102, 103). In regard to claim 4, at least one part flow (part of 21) of the second refrigeration circuit is used for provision of cooling in a separation unit (B; part of the cooling for separation in B is provided by part of the flow in 21 and heat exchanger 100; column 11, line 36). In regard to claim 5, Dubar teaches the volumes and/or evaporation pressures of two part flows (part of flows in 12 and 14) are changeable (as compressors can operate at different pressures and flow rates).

Claims 1, 5-6 are rejected under 35 U.S.C. 102(b) as being anticipated by Paradowski (US 4539028). In regard to claims 1, 5-6, Paradowski teaches a method for the liquefaction of a hydrocarbon-rich flow (1), whereby the liquefaction of the hydrocarbon-rich flow is effected against a refrigerant circuit cascade consisting of three refrigeration

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circuits (see the designation of each below), whereby the first (51, 68, 74, 62) of the three refrigeration circuits serves to provide preliminary cooling (within 6; column 8, lines 36-38), the second refrigeration circuit (49, 69, 75, 63) serves to provide liquefaction (column 8, line 48), and the third refrigeration circuit (18, 19, 22, 23, 4) serves to provide sub-cooling (within 4; column 8, lines 36-38) of the liquefied hydrocarbon-rich flow, and whereby each refrigeration circuit comprises at least one single-stage or multi-stage compressor (50, 49, 48, 18, 19, 22, 23), wherein at least one part flow (part of 69) of the refrigerant of the second refrigeration circuit (49, 69, 75, 63) is drawn off after providing preliminary cooling (part of flow 69 is sent after providing cooling in the first circuit) and is returned for additional preliminary cooling (after passing through circuits three and two again) of the hydrocarbon-rich flow (1); additionally, the volumes and/or evaporation pressures of two part flows (part of flows in 12 and 14) of the second refrigeration circuit (49, 69, 75, 63) are changeable (as expander 62 can operate with different pressures and flow rates and therefore different volumes, also compressors may operate at varying speeds).

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Carr (US 3315477) in view of Stockman.

In regard to claim 1 and 6, Carr teaches a method for the liquefaction of a hydrocarbon-rich flow (1), whereby the liquefaction of the hydrocarbon-rich flow (1) is effected against a refrigerant circuit cascade consisting of three refrigeration circuits (propane, ethylene, methane fluid lines), whereby the first (propane lines) of the three refrigeration circuits serves to provide preliminary cooling (in 2, 3, 19, 22, interpreted as cooling of the natural gas before liquefaction of the natural gas begins), the second refrigeration circuit (ethylene lines) serves to provide liquefaction (via at least 28, 31, 32, 33), and the third refrigeration circuit (methane lines) serves to provide further cooling of the natural gas after liquefaction has begun of the liquefied hydrocarbon-rich flow (1), and whereby each refrigeration circuit comprises at least one single-stage or multi-stage compressor ((11, 17), (column 2, line 40); (59, 60, 61, 67)), wherein at least one part flow (part of flow from ethylene compressors to 19 and 22) of the refrigerant of the second refrigeration circuit (ethylene lines) is drawn off after being cooled (in 19, 22) and is returned to provide additional preliminary cooling (ethylene is expanded and is

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used to cool the natural gas before liquefaction of the natural gas via heat exchangers 25, 26, 27 at least) of the hydrocarbon-rich flow (1).

Carr does not appear to explicitly teach that the natural gas is subcooled in the third refrigeration circuit (methane lines). However, it is well known to subcool a liquid natural gas as taught by Stockman (column 4, lines 20-25). Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify the third refrigeration circuit (methane lines) of Carr to subcool the liquefied natural gas for the purpose of minimizing the amount of natural gas product that is lost to evaporation during subsequent processing. In regard to claim 2, Carr teaches the part flow (part of ethylene) of the refrigerant of the second refrigeration circuit (ethylene lines) used for the pre-cooling of the hydrocarbon-rich flow (1) is evaporated at a pressure (column 2, lines 40-42; see pressures on figure) which is higher than an evaporation pressure of a remaining part flow (part of ethylene used in heat exchangers 28, 31, 32, 33) of the refrigerant of the second refrigeration circuit (ethylene lines), and is conducted to the compressor (ethylene compressor) of the second refrigeration circuit (ethylene lines) at an intermediate pressure level (see pressures on figures). In regard to claim 3, Carr teaches separation of unwanted components (column 1, lines 55-60) before the liquefaction of the hydrocarbon-rich flow (28, 31, 32, 33). In regard to claim 4, Carr teaches at least one part of the second refrigeration circuit (part of ethylene) is used for cooling in a separation unit (36; as part of the cooling of the natural gas to make the separation in 36 possible is provided by a part of the flow of ethylene). In regard to claim 5, Carr teaches that the volumes and/or evaporation pressures of two

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part flows (flows through heat exchangers 25, 26, 27 and through 28, 31, 32, 33) are changeable (as compressor can operate at different pressures and flow rates and valves can operate at varying pressure drops).

Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Marco (US 3413816) in view of Stockman.

In regard to claim 1 and 6, Marco teaches a method for the liquefaction of a hydrocarbon-rich flow (1), whereby the liquefaction of the hydrocarbon-rich flow (1) is effected against a refrigerant circuit cascade consisting of three refrigeration circuits (propane, ethylene, methane fluid lines), whereby the first (propane lines) of the three refrigeration circuits serves to provide preliminary cooling (in 21, 31, 39, interpreted as cooling of the natural gas before liquefaction of the natural gas begins), the second refrigeration circuit (ethylene lines) serves to provide liquefaction (via at least 63, 95, 113), and the third refrigeration circuit (methane lines) serves to provide further cooling of the natural gas after liquefaction has begun of the liquefied hydrocarbon-rich flow (1), and whereby each refrigeration circuit comprises at least one single-stage or multi-stage compressor ((23, 49), (69, 99, 121), (150, 173, 195)), wherein at least one part flow (part of 75) of the refrigerant of the second refrigeration circuit (ethylene lines) is drawn off after being cooled (in 39) and is returned to provide additional preliminary cooling (ethylene is expanded and cools natural gas before liquefaction of the natural gas via heat exchangers 63, 95, 113) of the hydrocarbon-rich flow (1).

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Marco does not appear to explicitly teach that the natural gas is subcooled in the third refrigeration circuit (methane lines). However, it is well known to subcool a liquid natural gas as taught by Stockman (column 4, lines 20-25). Therefore, it would have been obvious to one of ordinary skill in the art, at the time the invention was made, to modify the third refrigeration circuit (methane lines) of Marco to subcool the liquefied natural gas for the purpose of minimizing the amount of natural gas product that is lost to evaporation during subsequent processing. In regard to claim 2, Marco teaches the part flow (part of 75) of the refrigerant of the second refrigeration circuit (ethylene lines) used for the pre-cooling (in 63) of the hydrocarbon-rich flow (1) is evaporated at a pressure (column 4, line 20-25, 35) which is higher than an evaporation pressure (column 5, line 4; column 5; line 34) of a remaining part flow (part of ethylene used in heat exchangers 95, 113) of the refrigerant of the second refrigeration circuit (ethylene lines), and is conducted to the compressor (ethylene compressor) of the second refrigeration circuit (ethylene lines) at an intermediate pressure level (see citations of pressures above). In regard to claim 3, Stockman teaches separation of unwanted components (column 5, lines 45-50) before the liquefaction of the hydrocarbon-rich flow (using LRC). In regard to claim 4, Stockman teaches at least one part of the second refrigeration circuit (LRC) is used for cooling in a separation unit (T2; as cooling for separation in T2 is provided by part of the LRC). In regard to claim 5, Marco teaches that the volumes and/or evaporation pressures of two part flows (flows through heat exchanger 63 and through 95, 113) are changeable (as compressor can operate at different pressures and flow rates and valves can operate at varying pressure drops).

### ***Response to Arguments***

Applicant's arguments filed 9/10/2010 have been fully considered but they are not persuasive. Applicant's arguments (page 7, ¶ 2) are that the prior art does not show that the part flow of Stockman is employed in a first heat exchanger. In response, it is noted that the claims make no stipulation that the part flow of the second refrigeration circuit must provide cooling to a first heat exchanger. All that the claims require is that a part flow of the second refrigeration circuit is drawn off and returned for additional preliminary cooling. As noted in the rejections above preliminary cooling is interpreted to be cooling of the natural gas before the natural gas liquefies and therefore since the prior art teaches that the part flow is drawn off and returned to provide additional cooling of the natural gas before the natural gas is liquefied, the claim limitation is met.

### ***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to John F. Pettitt whose telephone number is 571-272-0771. The examiner can normally be reached on M-F 8a-4p.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Cheryl Tyler or Frantz Jules can be reached on 571-272-4834 or 571-272-6681. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/John F Pettitt /  
Examiner, Art Unit 3744

/Cheryl J. Tyler/  
Supervisory Patent Examiner, Art  
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JFP III  
October 7, 2010